Issue 04-08

INEEL develops computer tool to help save archaeological treasures

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Electronic newsletter from Communications for employees of the INEEL

If he'd only had an office computer and online treasure maps, Indiana Jones might have avoided all those snakes, scrapes and sneaky rivals.

Now, archaeologists exploring the southeastern Idaho desert have a new tool that Indy would really die for. Computer scientists at the U.S. Department of Energy's INEEL have developed a geographic computer system that sifts through data from various sources to help find and map archaeological sites. The system will save archaeologists time, money -- and maybe some digging.

Archaeologists need to protect 12,000 years' worth of artifacts lying forgotten among the sagebrush and basalt on the Idaho National Engineering and Environmental Laboratory's 890-square-mile desert site. To help them, scientists in the INEEL's Ecological and Cultural Resources Department developed a computer program that merges data about the history, anthropology and archaeology of the terrain into one integrated system. Users can navigate through a friendly interface to call up detailed information and draw customized interactive maps. Computer scientist Sera White demonstrated the system Aug. 12 at the 2004 Environmental Systems Research Institute International User Conference in San Diego.

The new tool will help the archaeologists keep tabs on artifacts ranging from 12,000-year-old mammoth bones to 150-year-old pioneer homesteads -- and even help them predict where more pieces of the historic puzzle might be found, says Brenda Ringe Pace, the lead INEEL archaeologist helping develop the geographic system. White says the system, which she dubbed the Data Management Tool (DMT), will save archaeologists time as they juggle various types of maps and geographic data. "Before, they had to hand-draw maps, then copy and scan them," she says. "Now all they have to do is hit print."

As required by federal law, archaeologists work with state, local and Shoshone-Bannock tribal governments to preserve and protect the INEEL site. Yet the archaeologists collect more than just arrowheads and antique muskets; they're also the storekeepers of knowledge about the land. And with about 1,200 archaeological sites already found at the INEEL -- and more than 90 percent of the area still unsurveyed by archaeologists -- retrieving and sharing data can be as important as collecting the facts themselves.

Organizing this sprawling collection of information was the real challenge, White says. A backbone of three separate databases -- historical, archaeological and anthropological research of the INEEL site -- supports the DMT. Geographic Information System (GIS) technology then ties the information together and presents it in interactive maps. White's method of connecting multiple databases to a single geographic interface is one of the first of its kind, she says, and is the subject of her conference presentation. Because of this seamless integration, researchers can easily dip into each database to customize maps according to their needs.

To create a new map with the DMT, the archaeologists start with a basic outline of INEEL terrain, White explains. Then they add color-coded layers of information -- locations of bodies of water and pioneer trails, for example -- as if they were adding sheets of illustrated transparencies over a printed map. The researchers can further fine-tune the maps by telling the program to display only certain types of information, such as archaeological sites greater than 5,000 years old.

Without the automated DMT program, some routine tasks could take the archaeologists hours, Pace says. Requests for information by federal project managers would send them to the filing cabinets on a hunt for old survey records. "Before, I used a photocopy machine and white-out to prepare official reports," Pace says. "With the automatic formatting, it's so much easier to use. It's all at my fingertips." And researchers can often bypass the printed page entirely. "Now I can transmit everything electronically," she says.

White also wanted to help Pace and her colleagues protect their sensitive archaeological information. She stored the system on a secure computer server rather than a vulnerable desktop computer. Not only does this let the archaeologists work easily from their own desks, Pace says, "but it also keeps data out of the wrong hands. Our primary goal is to protect those sites out there."

White designed the system to be easy to use, especially for researchers who may be more familiar with a pickaxe than with a PC. Having the DMT on a central server reassures users, White says. They can experiment with the program's features all they want, but its core mechanism is safely hidden away on the server, untouched by their tinkerings. "It's online," White explains. "You can't break it. If things go bad, you just close down the window and start again." She even piled the archaeologists' most-used database routines together into single commands, so that one click of the mouse is sometimes all a user needs.

One part of the DMT ventures even beyond known artifacts, Pace says, and takes archaeologists into the realm of possibilities. This experimental tool, developed by researchers at the INEEL and Idaho State University, predicts where new archaeological sites lie preserved in the unexplored desert. To do this, a mathematical model crunches through recorded data, such as results of past

archaeological surveys and locations of dried-up lakes. In a sense, Pace explains, the program puts itself into the mind of an early hunter-gatherer. It finds the most attractive places to set up camp, such as near water or along travel routes, and then maps these out for the archaeologists. “Wherever the hunter-gatherer families were likely to be, that’s where we have the best chance of finding the artifacts that tell their story,” Pace says. Planners can also use the feature to find potentially important archaeological sites before building new facilities.

As the DMT evolves, Pace and White hope it will eventually take them on a tour of the desert -- without leaving their air-conditioned offices. The researchers plan to add a feature to the DMT’s toolbox that will bring a topographical map to life, showing all the canyons and buttes of the land in three interactive dimensions. They’ll be able to see the terrain in ways even their own two eyes can’t provide, Pace explains. In the program's virtual world, for example, developers could erect a new building on a proposed site and then tour the area. The on-screen visit would give a preview of the construction's lasting imprints on the landscape.

Thinking about the effects of today’s actions on tomorrow’s land is important, Pace says. Many DOE sites across the nation are home to significant archaeological discoveries, and in the 1960s, legislators set up laws to try to preserve these resources for future generations. Since geographic isolation and high-security rules have kept human disturbance to a minimum, artifacts on DOE land are often remarkably well preserved.

The combination of circumstances, Pace says, lets tribal governments, archaeologists and historians study and protect these rare slices of history.

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